

### Abstract

#### Storing Water in Substrates For Frozen, Boot-Strap Start of Fuel Cells

Fuel cells (16) include a proton exchange membrane (18) with cathode catalyst (24) and anode catalyst (20) on opposing surfaces thereof. An anode support plate (21) includes a hydrophilic substrate (22) and a cathode support plate (25) includes a hydrophilic substrate (26) and a contact bilayer (diffusion layer) (24). Water transport plates (12, 14) are adjacent corresponding support plates. Upon shut down of the fuel cell stack, the support plates (21, 25) fill to 60% - 80% of their water capacity, thereby to provide water (from melting ice) upon a bootstrap start of the frozen cells. In one embodiment, the amount of water is controlled by the pressure differential between the coolant and the reactant gases; in another embodiment, the amount of water is controlled by having hydrophobic regions (93) substantially uniformly dispensed in a hydrophilic substrate (94) in either the support plates (22a) or the contact bilayer (27).